

Bornet (who only worked with dried specimens), especially as to the systematic position of *Meliola*, and the opinion that they are representative tropical species of the European *Erysipheæ*. He shows that the original cell, from which the *Perithecium* is developed by continuous cell-multiplication, must be regarded as containing in itself the undifferentiated elements of an *Archecarpium* and *Antheridium-branch* (in the sense of De Bary and others); and that after the primary division into two unequal cells, we must look upon one of these—the more slowly divided *ascogenous* cell—as an *Archecarpium*, which produces the *asci* and *spores*, &c., while the other more rapidly developing cell may be considered the equivalent of the *Antheridium* and enveloping tissues of such a fruit-body as that of *Erysiphe*. Thus the sexual process, reduced to a minimum (physiologically) in *Erysipheæ*, has here disappeared entirely, the morphological equivalents of sexual organs being also further withdrawn. One step further, and we arrive at forms in which no trace of sexual organs exist. The *Meliolas* must therefore be regarded as a group, developed along similar lines to those of the *Erysipheæ*, *Eurotium*, &c., but in which the sexual process has become suppressed to a still greater extent.

With respect to the pathological action of these fungi on their hosts, the investigations show that no direct parasitic action of the *mycelium* is recognisable; the rudimentary *haustoria* do not injure the cell-contents, nor even pierce the cell-walls. Injury results indirectly, however, because the well developed *mycelium* deprives the leaves of light, air, &c., and blocks up the *stomata*.

III. "Note on a Discovery, as yet unpublished, by the late Professor F. M. Balfour, concerning the Existence of a Blastopore, and on the Origin of the Mesoblast in the Embryo of *Peripatus Capensis*." By Professor MOSELEY, F.R.S., and ADAM SEDGWICK, M.A., Fellow of Trinity College, Cambridge. Received December 4, 1882.

The late Professor F. M. Balfour left a considerable amount of material, both in the form of drawings and MSS., which he had intended to employ in the publication of a monograph on the anatomy and development of the members of the genus *Peripatus*, together with an account of all known species. The portions relating to anatomy and development have been prepared for the press, and will in the course of some months appear in the "Quarterly Journal of Microscopical Science" in full; but as some of the embryological results are of especial interest and of general morphological importance, it

has been considered more expedient that these should at once be communicated to the Royal Society in the present note.

The Blastopore.—Balfour left no manuscript account or notes of his discovery in connexion with the drawings which he prepared in order to illustrate it, but he spoke about it to Professor Ray Lankester and also to us, and he further gave a short account of the matter in a private letter to Professor Kleinenberg, from which, by the courtesy of that distinguished embryologist, the following extract is made :—

“There is (in the early embryo of *Peripatus capensis*) along the whole ventral surface a groove which leads into the alimentary canal, and, as shown in sections, the walls of the alimentary canal give off pouches like those in *Amphioxus*, which form the mesoblastic somites. The hypoblast cells are large and filled with yolk, but the alimentary canal has a clear lumen. I have not yet got earlier stages, and the next later stages only differ from that described in the fact that the groove-like blastopore is closed and the mesoblastic somites are more numerous, while two widely separated thickenings of the epiblast constitute the first rudiments of the ventral nerve-cords.”

The drawings left by Balfour in connexion with the above remarkable discoveries are four in number: one of the entire embryo, showing the slit-like blastopore and the pouch-like outgrowths of the archenteron, the other three depicting the transverse sections of the same embryo.

The first drawing, viz., that of the whole embryo, shows an embryo of an oval shape, possessing six somites, whilst along the middle of its ventral surface there are two slit-like openings, lying parallel to the long axis of the body, and placed one behind the other. The mesoblastic outgrowths are arranged bilaterally in pairs, six on either side of these slits. The following note in his handwriting is attached to this drawing :—

“Young larva of *Peripatus capensis*. I could not make out for certain which was the anterior end. Length 1·34 millims.”

One of these openings is much longer than the other, and they present the appearance of having been once part of a single continuous slit, running nearly the whole length of the embryo. Balfour's own statement in the above letter, and two other embryos, which we have found among his material, prove that such is the case. These embryos, both taken from the uterus of the same female, are of two ages, but both are younger than that from which Balfour's drawing was made. The youngest is ·7 millim. in length and possesses three somites and a continuous slit extending along nearly the whole length of its ventral surface. The older one is ·86 millim. in length and possesses five somites. In this embryo the side walls of the middle portion of the slit have come together, preparatory to the fusion, which will almost immediately divide it into two parts. These two

embryos have been drawn by Miss Balfour, and will be figured in the first part of the forthcoming memoir above referred to.

Origin of the Mesoblast.—Balfour's three remaining drawings are, as already stated, representations of transverse sections of the embryo figured by him as a whole. They show that, as he stated in the letter quoted, the mesoblast originates as a series of paired outgrowths from the hypoblast, and that these outgrowths are formed near the junction of the hypoblast with the epiblast at the lips of the blastopore. The mesoblast can be seen in the actual sections to have the form of paired sacs, the cells forming which pass continuously unto those of the hypoblast. One of them distinctly shows that at the stage with six somites, communications exist between the cavity of the mesenteron and that of the mesoblastic somites, and there is no need for us to enlarge upon the importance of these facts. Their close bearing upon some of the most important problems of morphology will be apparent to all, and we may, with advantage, quote here some passages from Balfour's "Comparative Embryology," which show that he himself long ago had anticipated and in a sense predicted their discovery.

"Although the mesoblastic groove of insects is not a gastrula, it is quite possible that it is the rudiment of a blastopore, the gastrula corresponding to which has now vanished from development." "Comparative Embryology," vol. 1, p. 378.

"TRACHEATA.—Insecta. It (the mesoblast) grows inwards from the lips of the germinal groove, which probably represents the remains of a blastopore." "Comparative Embryology," vol. 2, p. 291.

"It is, therefore, highly probable that the paired ingrowths of the mesoblast from the lips of the blastopore may have been, in the first instance, derived from a pair of archenteric diverticula." "Comparative Embryology," vol. 2, p. 294.

They were discovered in June last, only a short time before he started for Switzerland; we know but little of the new ideas which they called up in his mind. We can only point to passages in his published works which seem to indicate the direction which his speculations would have taken.

"In the first place it is to be noted that the above speculations render it probable that the type of nervous system from which that found in the adults of the Echinodermata, Platyelminthes, Chætopoda, Mollusca, &c., is derived, was a circumoral ring, like that of Medusæ, with which radially-arranged sense-organs may have been connected; Its anterior part may have given rise to supra-oesophageal ganglia and organs of vision; these being developed on the assumption of a bilaterally symmetrical form, and the consequent necessity arising for the sense-organs to be situated at the anterior end of the body. If this view is correct, the question presents itself as to how

far the posterior part of the nervous system of the Bilateria can be regarded as derived from the primitive radiate ring.

"A circumoral nerve-ring, if longitudinally extended, might give rise to a pair of nerve-cords united *in front and behind*,—exactly such a nervous system, in fact, as is present in many Nemertines (the Enopla and Pelagonemertes), in Peripatus and in primitive molluscan types (Chiton, Fissurella, &c.). From the lateral parts of this ring it would be easy to derive the ventral cord of the Chaetopoda and Arthropoda. It is especially deserving of notice, in connexion with the nervous system of the above-mentioned Nemertines and Peripatus, that the commissure connecting the two nerve-cords behind is placed on the dorsal side of the intestines. As is at once obvious, by referring to the diagram (fig. 231 B), this is the position this commissure ought, undoubtedly, to occupy if derived from part of a nerve-ring which originally followed more or less closely the ciliated edge of the body of the supposed radiate ancestor." "Comparative Embryology," vol. 2, pp. 311, 312.

The facts of development here recorded give a strong additional support to this latter view, and seem to render possible a considerable extension of it along the same lines.

IV. "On the Refraction of Plane Polarised Light at the Surface of a Uniaxal Crystal. II." By R. T. GLAZEBROOK, M.A., F.R.S., Fellow and Lecturer of Trinity College, Demonstrator in the Cavendish Laboratory, Cambridge. Received December 4, 1882.

A paper of mine bearing the above title was read before the Royal Society in November, 1881, and has since been printed in the "Phil. Trans.," Part II, 1882. An abstract appeared in the "Proc. Roy. Soc.," No. 216, 1881.

While continuing with the same apparatus a series of measurements of similar nature, which have occupied me for the greater portion of the present year, I have just discovered a source of error which had hitherto escaped my notice, and which seriously affects all the results I have arrived at. I have been using a spectrometer made many years since by Grubb, of Dublin, for the late Dr. Robinson, of Armagh, and kindly lent to me by Professor Stokes.

A chance observation has showed me that the object-glasses of both collimator and telescope in this instrument are strongly doubly refracting.

If plane polarised light fall on either, the emergent beam is ellip-